Species Selection

Introduction

One of the important decision in agroforestry is the selection of species. In Agroforestry systems, people plants trees for fruit, fodder, fuel, shade, conservation purpose and various other purpose. Since a large varieties of tree are available which could grow in different edaphic climatic condition. People can select trees of their choice very easily. The plantation of trees and subsequent maintenance also depend on the agroforestry system. For example, in Shifting cultivation which is the most primitive form of agroforestry. Only fruit trees not cut while others are cut, dried and burnt to provide manure for agricultural crops. In other agroforestry systems, however trees are even more importance. They are deliberately introduced into land use. More recently, due to the generation of market opportunities for tree products greater attention has been paid to the selection of tree species in agroforestry in proper proportion.

Effect of Trees on Annual crops in Agroforestry system

In, Agroforestry system the effect of trees on the surrounding annual crops is an important consideration. The tree species, which cause no or least damage to agricultural crops should be given preference. The following consideration is important:

1. Species selected for Agroforestry system, should possess self pruning properties.

2. If not self pruning, they should be able to tolerate frequent pruning.

3. They should have small canopy and their phyllotaxies should permit the penetration of light on the ground.

4. Their phenology with respect to leaf fall should be advantageous to the growth of the annual crop.

5. Their rate of litter fall and litter decomposition should have a positive effect on the soil.

6. Their root system and root growth characteristics should be such that it offers less competition to agricultural crops for nutrient and water.

7. They should be efficient in nutrient pumps.

Characteristics of an ideal tree for Agroforestry system

An ideal tree for an agroforestry system should be examined with respect to its-

a. Root characteristics.

b. Crown characteristics.

c. Bole characteristics.

d. Phenological characteristics.

e. Nutrition and water absorption characteristics.

f. Growth characteristics.

g. Shelter to insect, pest and disease.

Root characteristics

When woody perennials are grown with annual crops, it is necessary that root distribution of trees should be below 40 cm soil layers ad most of the annual crops have their roots distribution in the upper 30-40 cm soil layers. If tree roots are distributed on the surface layer of the soil they will compete with agricultural crops for nutrient and water but also cause obstruction in normal soil working.

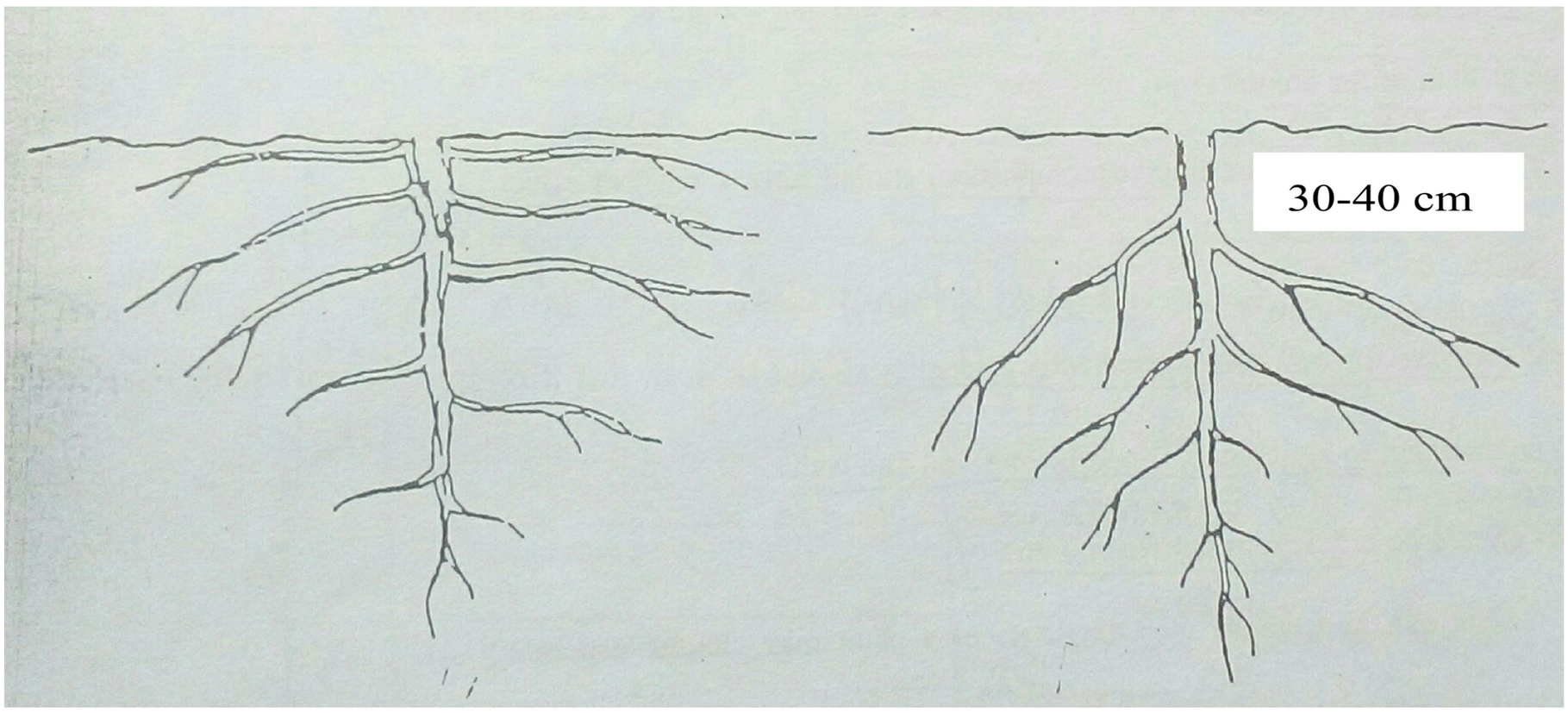
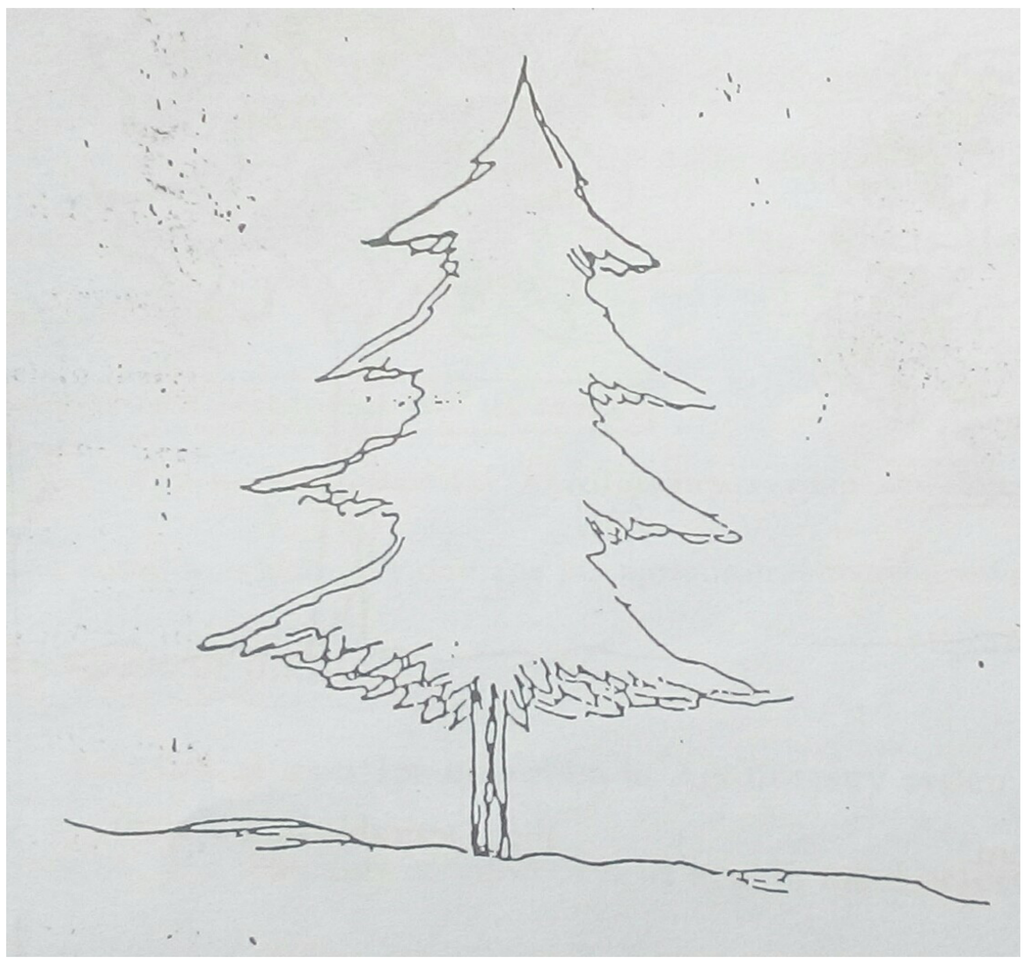


Fig: Undesirable root system.

Fig: Desirable root system

Crown characteristics

The characteristics of a crown which are important from the Agroforestry point of view include (i) Density (ii) Size (iii) Shape (iv) Height etc trees having a dense crown do not permit enough light on the soil which adversely affects the process of photosynthesis in agricultural crops. The trees therefore, should have light crown which permit enough light in the ground for photosynthesis activity of agricultural crops. Several trees such as *Eucalyptus, Embhca, Acacia* etc have a lighter crown than *Mangifera, Tectona* and *Dalbergia* etc in agroforestry. The smaller tree crown, the better for the mixture. The crown size and bole diameter should be as low as possible.



Bole Characteristics

The tree bole should be straight and long so that it can minimum shade to the surrounding crops. Several trees such as *Eucalyptus, Csuarina* etc have a long clear bole. The trees should have self pruning characteristics. If not they should tolerate a high incidence of artificial pruning, *Dalbergia sissoo* is good example of such tree which tolerate severe pruning, develop a relatively clear bole and produce quality timber.

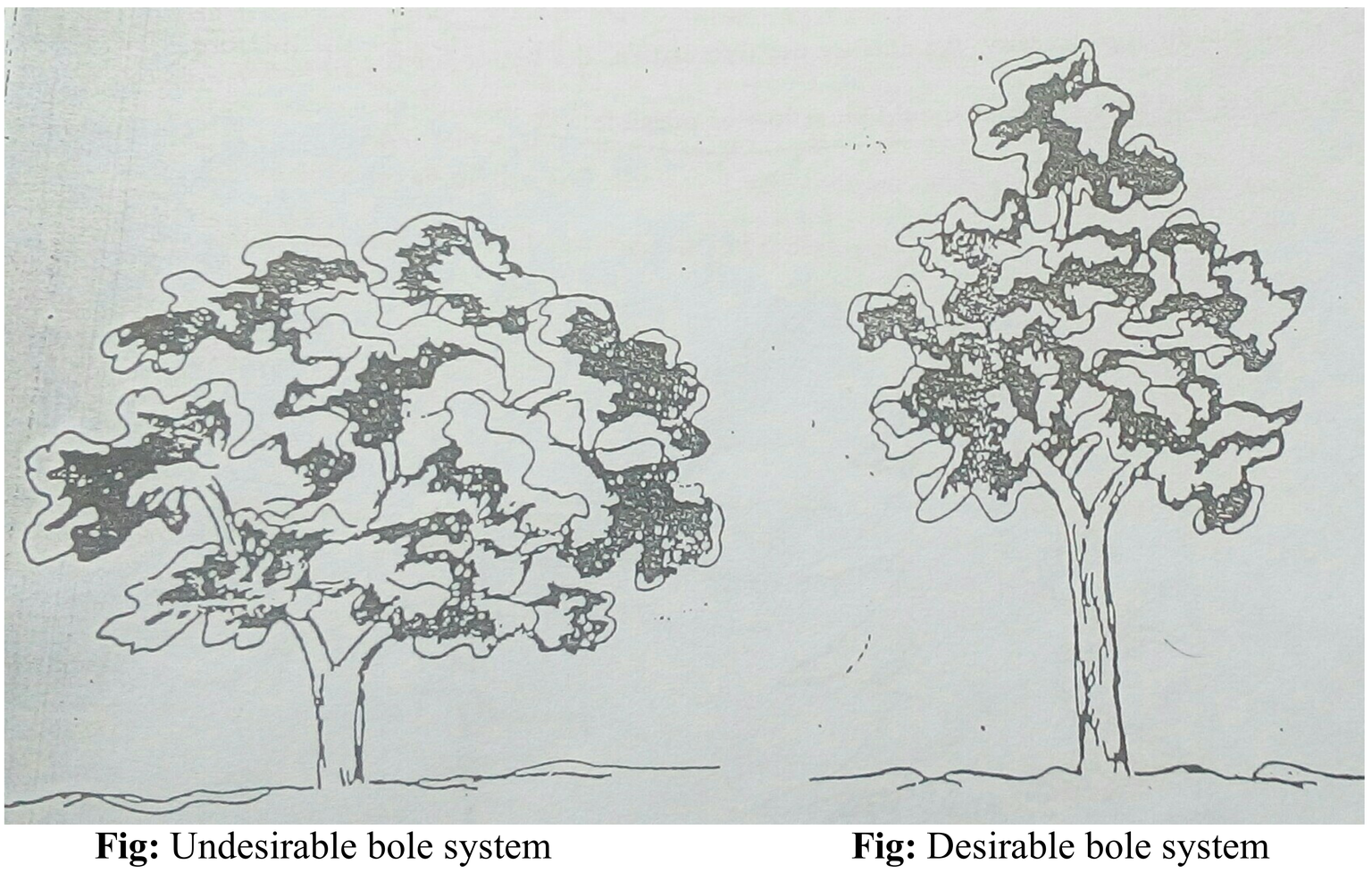


Fig: Undesirable bole system

Fig: Desirable bole system

Phenological characteristics

Phenological characteristics leaf falls, emergence of new leaf, phyllotaxies etc are considered for selection of trees. Deciduous trees are especially suitable for this purpose because the competition for light, nutrient and moisture are less during the period of leaflessness. Therefore, the longer the period of leaflessness the better for the growth of agricultural crops. Again, leaf litter of deciduous trees adds organic matter in soil and help to maintain sustainability of the productivity of the soil.

Nutrition and water requirement

Woody perennials when grown with agricultural crops it should be such that the requirement of water and nutrient are minimum.

Growth characteristics

The species selected for Agroforestry should essentially be fast growing. It should be able to with stand competition during early stage particularly when species are being selected for inter cropping. The trees should be capable of standing lopping, pruning and browsing.

Shelter of insect, pest and disease

The trees selected for agroforestry system should not harbour such insect, pests and disease which may damage the agricultural crops growing in association with it.

Factors Influence the Selection of Species

In general the factors influence in selection of spices for agroforestry are as follows-

1. Site factors.
2. Effect on annual crops.
3. Purpose of plantation.
4. Type of agroforestry system.
5. Marketability of produce.
6. Multipurpose trees.
7. Availability of tree species.
8. Types of tree and crop species.
9. Tree function.
10. Minimum temperature.
11. Soil condition.
12. Light constraints.
13. Drainage and soil water.
14. Pest and disease.
15. Space availability.

Multipurpose Trees (MPTs) in Agroforestry

The term "multipurpose tree" refers to all woody perennials that are purposely grown so as to provide more than one significant contribution to the production or service functions (food, fodder, fuel, timber, shelter, shade, land sustainability) of the land use system they implement. Accordingly, a tree which will serve more than one purpose is a multipurpose tree. A single tree may serve more than one purpose. For example, *Gliricidia sepium* that in addition to green manure provides fuel, fodder and acts as live fence.

Characteristics of MPTs suitable for Agroforestry

1. Adaptability to local climatic conditions.
2. Easy of establishment from seeds and seedlings.
3. They should have a low crown diameter to bole diameter ratio.
4. They should be light branching in their habit.
5. They should tolerate relatively high incidence of pruning.
6. Deep thrusting tap root system, few and shallow lateral roots (or prunable).
7. Their phyllotaxies should permit penetration of the light of the ground.
8. Coppicing ability.
9. Effective nutrient recycling.
10. Multiple uses: food, feed, firewood, construction materials and other products and service (shade, shelter etc.)

11. Minimal competition with shallowly rooted annual crops.
12. Small leaflets readily detached when dried and quickly decomposed when used as fertilizer.
13. A high proportion of leaves to secondary branches.
14. Good tolerance for drought, low fertility and others.
15. Freedom from pests and diseases.
16. Not compete for moisture, space and air.
17. Ability to fix atmospheric nitrogen.
18. Supply nitrogen in the soil.
19. Have thin and erect leaves.
20. Maintain proper ecosystem.
21. Non-allelopathic effects on arable crops.
22. Easy to propagates and prolific seed producer.

Benefits/ Services from MPTs

The benefits from MPTs can be summarized as follows:

A. Food

1. Human food from trees (fruits, nuts, leaves etc.).
2. Livestock feed from trees.
3. Improved nutritional status of food and feed crops through:

    i) Nitrogen fixation.

    ii) Access to greater volume of soil nutrients through deep rooting trees.

    iii) Improve availability of nutrient associated with higher oat ion exchange capacity and organic matter levels.

4. Increased crop production through soil and water conservation.

B. Energy

1. Firewood for direct combustion.
2. Pyrolytic conversion products (charcoal, oil, gas etc.)
3. Produces gas from wood or charcoal feed stocks.

4. Ethanol from fermentation of high carbohydrate fruit.

5. Methanol from destructive distillation or catalytic synthesis processes using woody feedstock.

6. Oils, latex, other combustible and resins.

C. Shelter

1. Building materials for shelter construction.
2. Shade trees for humans, livestock's and shade loving crops.
3. Windbreaks and shelter belts for protection of settlements, crop land and pastures.
4. Living fences.

D. Raw materials for processing

1. Wood for a variety of craft purpose.
2. Fiber for weaving industries.
3. Fruits, nuts etc for drying another food processing industries.
4. Tannins, essential oil, medicinal ingredients.

E. Cash

1. Direct cash benefits from sale of above listed production.
2. Indirect cash benefits from increased production of crops or livestock.

F. Long term benefits

1. Increased crop productivity.
2. Sustain crop productivity.
3. Improve environmental condition.
4. Improve socioeconomic condition.

Coppicing

In Coppicing whole tree is cut off close to ground level. Shoots sprout from the residual stump technically referred to as the stool. Removal of the trees leading shoots results in hormonal suppression of lateral growth which triggers growth of dormant buds on the side of the trunk. Coppice growth is generally much more vigorous than normal seedlings growth.

Points to keep in mind during coppicing

1. Trees should be coppiced only when attains good health and shade effect is too much on the inter crops.

2. Trees should be coppiced when attains 3-5 meter height.

3. Trees should not coppiced in dry period. In dry fallow period shade of trees help in moisture conservation.

4. Coppicing should be done one week before the onset of the rains.

5. The optimum cutting height for most of the coppicing trees should be kept in between 30-50 cm above the ground level.

6. Initial cut must be angled to permit rainwater to run off from the cut surface easily.

7. In case of poor shoot growth mature trees should be harvested and replanted by new seedlings.

Allelopathy

The majority of inhibiting chemicals are produced as secondary substances by plants and released into the soil through the roots or leaf wash. The suppression of growth through the release of chemicals by a higher plant is known as allelopathy.

Thus, alleopathy (allelon = each other + pathy = suffering) means chemical control of distribution among plants.

Allelopathic interactions are an important factor in determining species distribution and abundance within plant communities and are also thought to be important in the success of many invasive plants.